THE WINTER TERRITORIES OF TUFTED TITMICE

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The winter behavior of Tufted Titmice (*Parus bicolor*) raises many questions. This study attempts to answer three: (1) What area does an individual titmouse cover during its normal winter activities? (2) What relation does the winter area covered by one titmouse bear to that of the other titmice in the general locale? (3) To what extent do titmice associate in flocks with a stable membership, and in flocks of what size?

METHODS

The basis for the answers is the observation of 20 color-banded titmice for varying periods during a seven-month span (1 September 1967 to 1 April 1968). These birds inhabited the southeast slope of Mount Nittany, in Centre County, Pennsylvania, near the town of State College. The study area was 5400 feet long (from southwest to northeast) and 1800 feet wide (from southeast to northwest). The elevation ranged from 1300 feet above sea level (the southeast edge) to about 2000 feet (the ridge of Mount Nittany at the northwest edge). About 20 per cent of the land is open pasture bounded by hedgerows of hawthorn, maple, black walnut, etc.; about 25 per cent is mixed oak forest ranging up to 80 feet in height, with little understory. About 40 per cent of the land, chiefly in a strip along the mountain, is mature deciduous forest—mixed oak, maple, and walnut, with an understory of dogwood, wild grape, etc., unbroken for more than the 5400 feet of the study area, and extending 600 feet down the mountain into the study area. About 15 per cent of the land is cut-over brushy woods, consisting mainly of immature mixed oak, maple, walnut, dogwood, hawthorn, wild grape, bittersweet, etc.

Several techniques and "rules" for locating the titmice were necessary in order to avoid the effect of a feeding station, which might distort the normal winter behavior of the birds. Four (occasionally five) traps operated simultaneously. Each trap was a Potter type, one-, two-, or three-celled, suspended from a tripod made by wiring together three eight-foot metal clothespoles. The traps were baited with about a cup of sunflower seeds (occasionally suet), and pinned open when not in use, thus functioning also, temporarily, as feeding stations.

Every trap was moved to a new location every time it caught a titmouse. The only exceptions were instances where a two- or three-celled trap caught additional titmice before I could return to the trap in my rounds. The purpose of moving the traps in this fashion was to reduce any "feeding-station effect" which might distort the birds' territories. Every trap was moved to another location at least every eight days whether or not it caught a titmouse. Since the traps were pinned open when not in use, they still might entice birds out of their normal territories, even though no birds had been trapped.

All traps were moved at least 100 yards and were not returned to a prior location, or within 100 yards of a prior location, until at least 13 days had elapsed. The eight-day and 13-day periods have no ornithological significance; they simply fit easiest into a pattern of weekend banding. In addition to trap-records, many birds could of course be traced by their color-bands.

RESULTS

Nineteen titmice were trapped and color-banded; in addition one unbanded titmouse avoided the traps late in the study period. The trappings and observations produced 141 place-time records. Of the 19 banded birds, 10 were adults in the autumn of 1967; of these, two were birds banded in the winter of 1965–66, five were banded in the winter of 1966–67, and three were adults first seen in the winter of 1967–68. The basis for distinguishing adults from immatures was mouth-color: light gray upper bill, immature; dark gray, adult (this is based on an unpublished manuscript of Professor Merrill Wood).

In addition to the 10 known to be adults, two birds were of unknown age, being trapped too late in the winter of 1967–68 to have shown immature characteristics. Seven of the 19 were immatures in the autumn of 1967.

Sexing was done by wing-chord measurement (based on an unpublished manuscript of Professor Merrill Wood): 78 mm or less, female; 79–82 mm, unknown; 83 and over, male. Six of these birds were male, five were female, and eight of unknown sex.

In March 1968 the weight of nine birds averaged 22.6 grams (extremes: 20.6, female, to 24.0, one male and one of unknown sex). The 14 titmice of Laskey (1957) in Tennessee averaged 20.5 grams; the 35 titmice of Nice (1933) in Ohio ranged from 20.3 to 25.3 grams.

Figure 1 shows the large patterns of the inter-relations of the titmice. In the study area there apparently were no more than 20 titmice during the period of the investigation: 19 color-banded birds and one unbanded bird seen once, 22 March 1968, at the lower right corner of Area A.

DISCUSSION

The titmice divided themselves into four "clans," designated in Figure 1 as A, B, C, and D. A term such as "clan" seems preferable to "flock" for two reasons: (1) because Gillespie (1930), Van Tyne (1948), and Laskey (1957) observed that the association of titmice during the winter season was a vestige of the family group of the previous season; (2) because an observer seeing a group or "flock" of titmice in certain parts of the area (specifically the overlaps in Figure 1) might be seeing titmice which *normally* group together (a "clan"), or he might be observing a mixed group from two different clans, birds which would soon separate as they moved to other parts of their respective territories.

The composition of each clan was as follows: Clan A—five birds: one male, age unknown; one adult male; one female, age unknown; two adults of unknown sex. Clan B—three birds: one adult male; one immature male; one immature female. Clan C—six birds: one adult male; one adult female; one immature female; three of unknown sex, one of them mature, the other

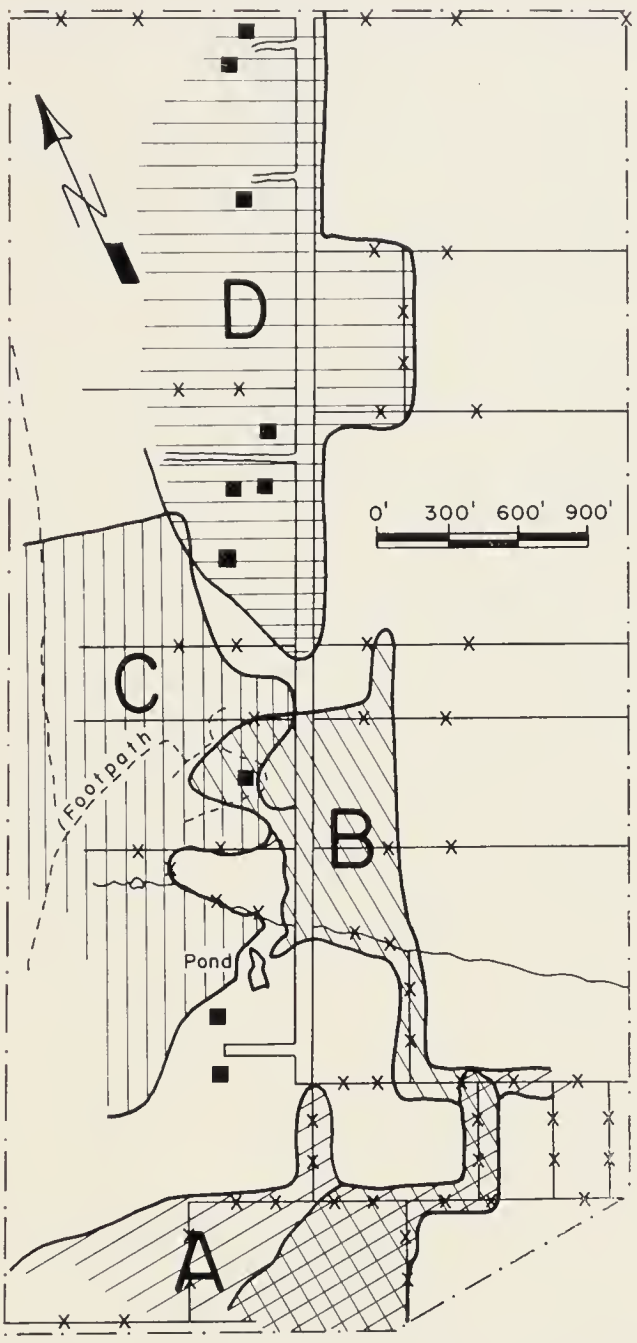

Fig. 1. Winter Territorial Boundaries of 19 Tufted Titmice. Territory A: five birds. B, three birds. C, six birds. D, five birds.

two immature. Clan D—five birds: one adult male; one immature female: three of unknown sex, one of them adult, one immature, and one of unknown age. In addition, as has been pointed out, there was one unbanded titmouse observed on 22 March 1968 in a part of the area visited by both Clans A and B.

Except in one instance, birds of a given clan were never observed outside the territories indicated by the letters A, B, C, and D in Figure 1. The

boundaries in Figure 1 rest on 141 observations and two assumptions: (1) that the territory indicated is the minimum for each clan; (2) that the boundaries of the territory can be determined roughly by drawing lines from one observed point to another along what seem to be the outermost points of the territory. These are not, then, *observed* boundaries; in most instances a titmouse at the territory's "edge"—if indeed it was an edge—flew toward the central area of the territory and not in any path that might be called a perimeter of the territory.

Offutt (1965) reports that "[breeding] territory appeared to extend from about fifteen feet above the ground to the treetops." This does not seem to be true of wintering territory. In winter the titmice associated with their clan at various heights and, except for the areas of overlap, almost invariably stayed away from other territories.

The maximum observed distance covered by any titmouse during the period of observation was approximately 3000 feet; 185, a female of Clan B, banded as an immature on 16 September 1967, was trapped at the northernmost limit of Territory B on 23 September 1967, and at the southernmost limit of Territory B (3000 feet away) on 26 March 1968. In Clan C, 187, of unknown sex, was trapped at the northernmost point in the territory on 29 February 1968, and at the southernmost, 2400 feet away, on 31 March 1968—the maximum distance for a titmouse of this clan. Territory D is at least 2500 feet long (its northernmost limit is known only to the titmice), but I found no one titmouse ranging the whole length of the territory. Nice (1933) writes that her flock of 8 birds ranged over about 20 acres.

Since these observations began well after the end of the breeding season, I can say nothing definite about the relations of the titmice within a clan. Laskey (1957) writes, "My [winter] records . . . indicate that the twosomes may be a mated pair, but not always. They may be birds hatched the previous summer, probably of the same brood, or a parent and a youngster. The small groups may be a family or a brood. I have not seen large groups." This would indicate the internal structure of Clan B as being a male parent with a male and a female offspring. But the internal relations of the other clans are not clear since each has three adults in it.

There are at least two possibilities: (1) that the clans are coalitions of the remnants of several summer families; (2) that the clans are really associations of smaller groups, and that my observations failed to detect the existence of these "septs" within the clans. For example, 794 (an adult of unknown sex) apparently never strayed outside Territory C; but it also never seemed to wander throughout all of C. Its appearances were limited to an east-west strip through the middle of Territory C. 136 (an adult male) ranged through the middle and northern parts of Territory C, but not to the

southern part. On the other hand, 187 (an immature of unknown sex) turned up almost everywhere within Territory C.

Previous banding of titmice (1965–67) at a fixed banding station in this area had resulted in a small number of returns at the end of the breeding season: of the 15 titmice banded between 15 September 1965 and 22 March 1966, only one returned during the winter season of 1966–67. The other 17 birds trapped that winter were previously unbanded.

In 1967–68, scattering the traps and widening the area of observation resulted in the return of three of the titmice from previous years, all of them in Territory A. With the exception of one observation, they never ventured as close as 1200 feet to the feeders and traps they had visited during previous winters. The previous (fixed) banding station had been in the area where (in Figure 1) Territories B and C overlap. One titmouse had appeared three times at this banding station in the spring of 1966, but it never came within 1500 feet of this site in 1967–68. Another bird had appeared 11 times at the banding station during the winter of 1966–67; it appeared there only once (15 March) in the winter of 1967–68. That trip is the only instance of one of these 19 birds moving outside the territorial boundaries of Figure 1 during the winter of 1967–68. A third titmouse had appeared twelve times at the 1966 banding station, but it never appeared in this territory at all in 1967–68. Although it was commonly evident during this period in Territory A, it always remained at least 1200 feet from its previous haunts. A similar phenomenon was noted by Short (1933) and Van Tyne (1948).

With regard to these movements from year to year, Van Tyne suggests that there are two classes of titmice: "*A*, those that remain in restricted home ranges throughout the year (hence repeatedly recorded in a small radius); *B*, those that wander (hence not recorded after banding). It seems reasonable to suppose that the former are fully adult birds; the latter, birds in their first winter wandering widely before settling on a home range."

On this point A. C. Bent (1946) quoted Dr. Dickey (MS.) who, "referring to Pennsylvania and West Virginia, says, 'Particularly in autumn and winter, tufted tits are rovers. . . . Bands . . . enter patches of weeds, flit along the courses of streams, cross country roads and highways, and peer forth from cover at farmyards.' . . . Several other observers have reported winter wanderings of titmice."

But this does not seem to account for the shift I observed between 1966 and 1968. Take two titmice—165 (adult, sex unknown) and 166 (adult male) as examples: I do not know if 1966–67 was their first winter, but they seem not to have been "wandering." Together they clocked 23 appearances at the banding station that winter. And their abandonment of their old territory in 1967–68 was almost total, while their adherence to their new territory was

quite close. The record for 017, an adult of unknown sex (banded 17 March 1966) points in the same direction, although there are fewer observations. This behavior looks less like wandering and more like a clearly defined immigration into a new winter territory.

But some titmice are apparently closely attached to a territory from year to year. For example 794, of unknown sex, was trapped in precisely the same spot on 14 October 1965 and 10 February 1968. It was trapped only 300 feet away from this spot on 20 November 1966, 26 April 1967, and 25 February 1968. Some titmice never leave "home," and others apparently shift their base of operations to a nearby area and never, or rarely, return even the short distance of 1200 feet to their previous territory.

My observations markedly disagree with those of Bent's informants. My titmice seemed to move as a group with the same "clan" (family?) and within a defined territory. There was no evidence of "wandering."

Certain clans seemed reluctant to approach each other. The area between A and C produced no records of either clan, and that between C and D produced very few records, although both areas were intensively trapped and observed. On the other hand I did find considerable overlapping in two areas. The point at which B and C overlap (in the center of Figure 1), and A and B overlap (at the bottom of Figure 1) can be described simply as areas with lots and lots of titmice around a great deal of the time. I could see no signs of conflict or territorial clash. It is probably significant that the point where B and C overlap was an excellent area for food—wild grape, hawthorn, bittersweet, oak, etc. And the area was visited by seven titmice: four from Clan C and three from B.

SUMMARY

Nineteen color-banded Tufted Titmice were trapped and observed on a tract 5400 feet by 1800 feet in the seven months from 1 September 1967 to 1 April 1968 in order to observe winter territorial activity. They restricted themselves to four territories with five, three, six, and five birds per territory. The territories seemed to be of irregular shape, making total areas impossible to state. The maximum distance between two points within one territory was 3000 feet. At two points territories were contiguous and few or no titmice were to be found; at two other points territories overlapped and the number of birds was quite high. No conflicts or territorial clashes could be seen. One clan of five titmice included three birds which had occupied another (nearby) territory one or two winters before, but which now remained almost completely outside their previous territories and within their new territory. Adherence to territory was close.

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